<u>WHAT IS CLAIMED IS:</u>

1. A disturbance estimated type control system comprising:

a control object;

disturbance estimating means for estimating a disturbance added to an input of the control object based on an input signal to be inputted in the control object and a detection signal detected from the control object;

compensating means for compensating for the detection signal and outputting a control signal; and

calculating means for subtracting a disturbance estimated by the disturbance estimating means from the control signal and considering a subtraction result as the input signal, wherein

a mathematical model (nominal model) of the control object comprising of a state equation and a transfer function is prepared by system identification based on an experiment,

the compensating means is designed from the mathematical model (nominal model), and

the disturbance estimating means is prepared from an expanded state equation (expansion system) comprising of a mathematical model (expansion model) taking a disturbance into account with respect to the mathematical model (nominal model).

2. A gas compressor control system comprising:

a variable displacement type gas compressor having displacement altering means that is capable of altering a

displacement within a compressing chamber;

an input signal to be inputted in the displacement altering means;

a detection signal in which at least one piece of information among an air temperature in a room, an air temperature at an outlet of an evaporator, a refrigerant flow, a refrigerant pressure on a suction side of a gas compressor and the like is detected;

disturbance estimating means for estimating a disturbance of the variable displacement type gas compressor based on the detection signal and the input signal;

compensating means for compensating for the detection signal to output a control signal; and

calculating means for subtracting a disturbance estimated by the disturbance estimating means from the control signal to consider a subtraction result the input signal.

3. A method of designing a disturbance estimated type control system comprising:

a control object;

disturbance estimating means for estimating a disturbance added to an input of the control object based on an input signal to be inputted in the control object and a detection signal detected from the control object;

compensating means for compensating for the detection signal and outputting a control signal; and

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calculating means for subtracting a disturbance estimated by the disturbance estimating means from the control signal and considering a subtraction result as the input signal, wherein

preparing a mathematical model (nominal model) of the control object comprising of a state equation and a transfer function by system identification;

preparing an expanded state equation (expansion system) comprising of the mathematical model and a mathematical model of a disturbance;

designing the disturbance estimating means from the state equation (expansion system); and

designing the compensating means from the mathematical model (nominal model).

4. A method of designing a disturbance estimated type control system according to claim 3, wherein

determining whether or not the state equation (expansion system) is observable; and

if it is determined to be unobservable, compulsorily adding an error of 10% or less to a coefficient corresponding to an A matrix and/or a C matrix of the state equation (expansion system) or a zero-th dimension term of a transfer function numerator and preparing an expansion system including the error, thereby establishing observability.